

TWR- 50060

THE EFFECTS OF AUTOCLAVE CURE TEMPERATURES ON
NON-SILICONE TEFLON TAPE WITH EPDM RUBBER

FINAL REPORT

OCTOBER 1989

Prepared for:

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
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Process Engineering Technical Report Categories

Curing	Heat
Manufacturing Processes	Stiffener Rings
Rubber, EPDM	Tape
Teflon	Temperature

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1.0 INTRODUCTION AND SUMMARY

The effect of elevated autoclave cure temperatures on non-silicone Teflon tape caused a bonding of the adhesive to EPDM rubber. There was adhesive failure between the tape backing and the tape adhesive on all samples. Therefore, this tape (Stock Nos. 57-742361, 57-742362, 57-742363) is not recommended for the use of securing cowl plates to EPDM rubber extrusions during the cure cycle.

The T-sections comprising the stiffener rings are 12.5 ft long. Three T-sections complete one stiffener ring. Two different EPDM rubber extrusions (#6100 and #5822) are used to cover the T-sections. The U-shaped covers the outside of the T-top and the angled-shaped covers the insides of the stem (Figure 1). Cowl plates are placed on all three sides of the T-top with silicone Teflon tape approximately every 1-2 feet (tape is 2-in. long), to hold the cowl plates in place during the autoclave cure cycle. These cowl plates have been known to shift toward the center (t-bar), and cut into the EPDM rubber.

RSRM Manufacturing Engineering requested the testing of a non-silicone Teflon tape during the autoclave cure cycle to determine:

1. The effects of heat on the non-silicone Teflon tape.
2. The ability of the tape to hold the cowl plates in place during cure.

After heating, the tape was extremely difficult to remove and had to be scraped and peeled away with razor and tweezers. The rubber underneath the peeled tape showed a significant color change of a khaki tan, rather than the normal black as in the other non-taped areas. The FT-IR spectrum for this area was the same as that for the FT-IR spectrum done on the tape alone (Attachments IV and V). EPDM not under the tape matched that of normal EPDM (Attachments I, II, and III).

There were no signs of any shifting on all three models.

2.0 CONCLUSION

The effect of high cure temperature was that the non-silicone Teflon tape was very difficult to remove and left the adhesive bonded on the EPDM rubber. Only the tape backing could be peeled off.

3.0 RECOMMENDATION

It is recommended that non-silicone Teflon tape NOT be used to secure cowl plates to EPDM rubber. However, polyester and hydrocarbon tapes, also, are not silicone and should be investigated.

4.0 NARRATIVE

Steel plates were spot welded together (Figure 2) on one side only to form a T-section model of the stiffener rings. Three models were made, each 12-in. long.

EPDM extrusion scraps from M-52 were used for layup of the models. Aluminum cowl plates were cut to size, cleaned with TCA, and wrapped in Teflon tape. The 205/236A Chemlok system was sprayed on the T-section models with the 2-in. and 3-in. width non-silicone Teflon tapes being used as follows:

Model 1: Control

No tape used.

Model 2: 2-in. Tape

Tape was applied as a continuous solid strip across the length of the T-bar and the T-top edge on the long extrusion side. The short extrusion side had no tape along the T-bar length and intermittently (2-in. ends and middle only) on the T-top edge (Figure 3).

Model 3: 3-in. Tape

Tape applied the same as Model 2.

Dacron patterning cloth, Stern #7777, and the green nylon vacuum film were used for vacuum bagging. The cure of Table I was used. After cure, small sections of rubber were cut for ATR/FT-IR spectrum analysis as was the non-silicone Teflon tape.

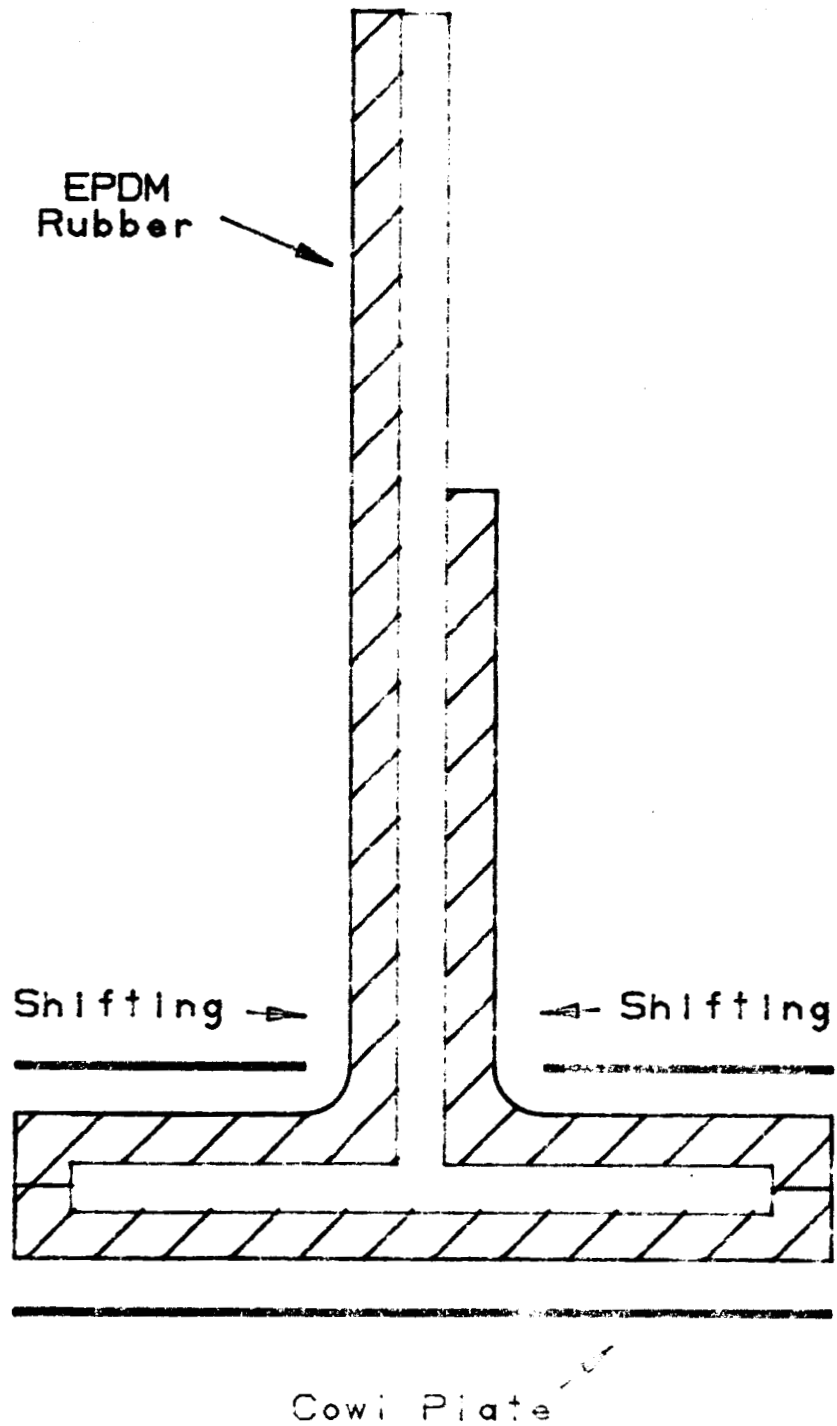


Figure 1. Cross-Section of T-Section Layout

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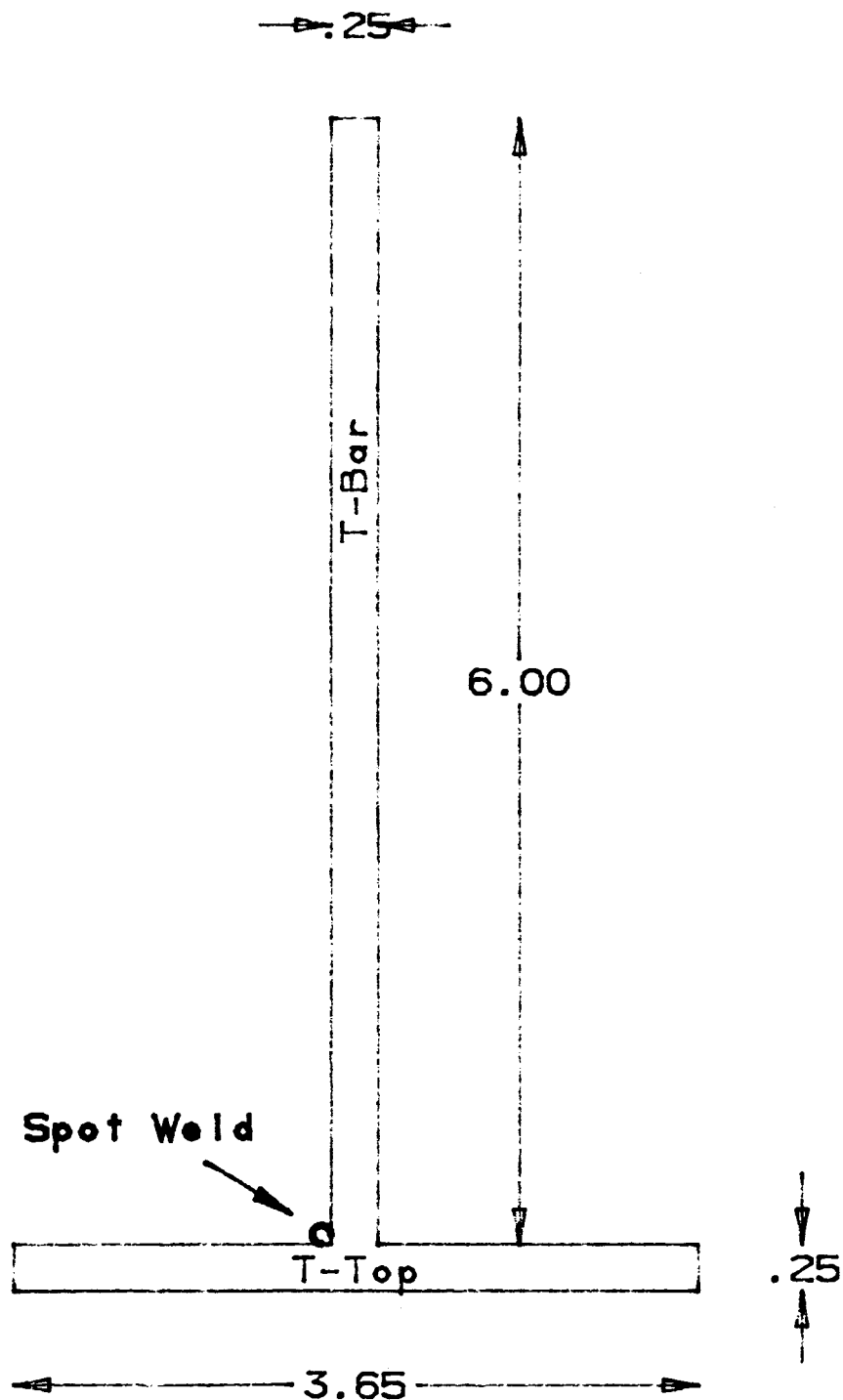


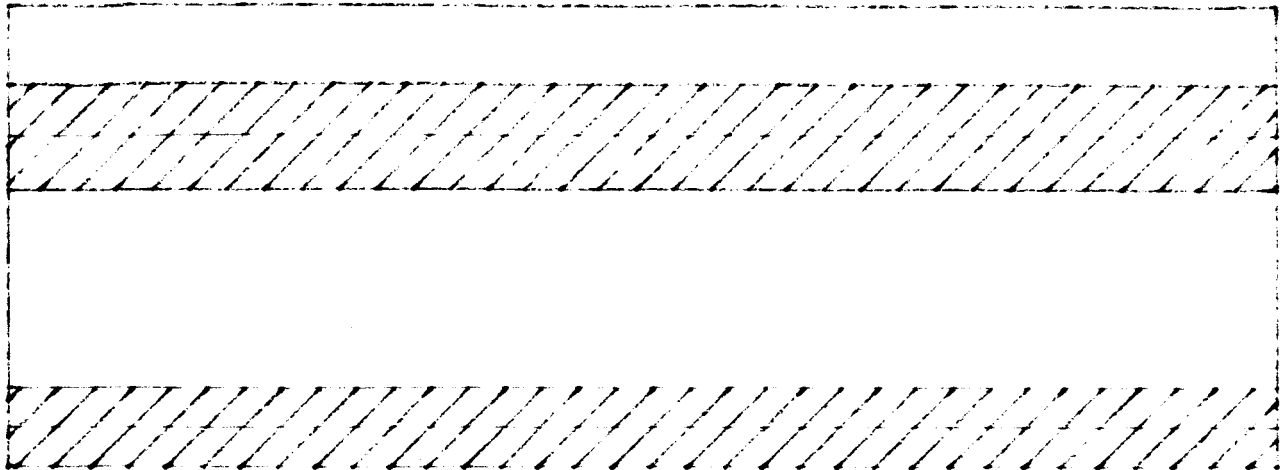
Figure 2. Cross-Section of T-Section Model

"PE409"

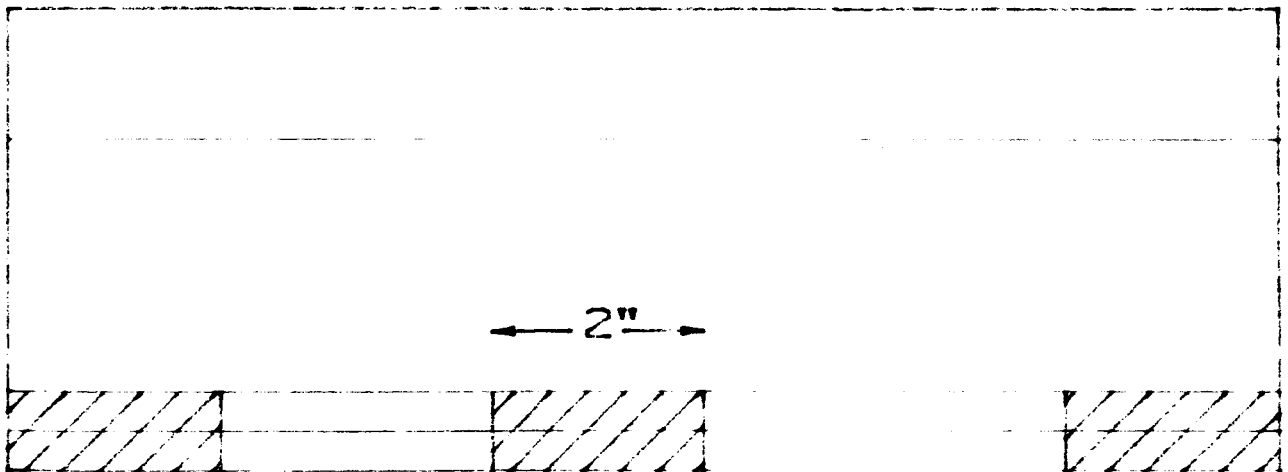
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Long Extrusion Side



Short Extrusion Side

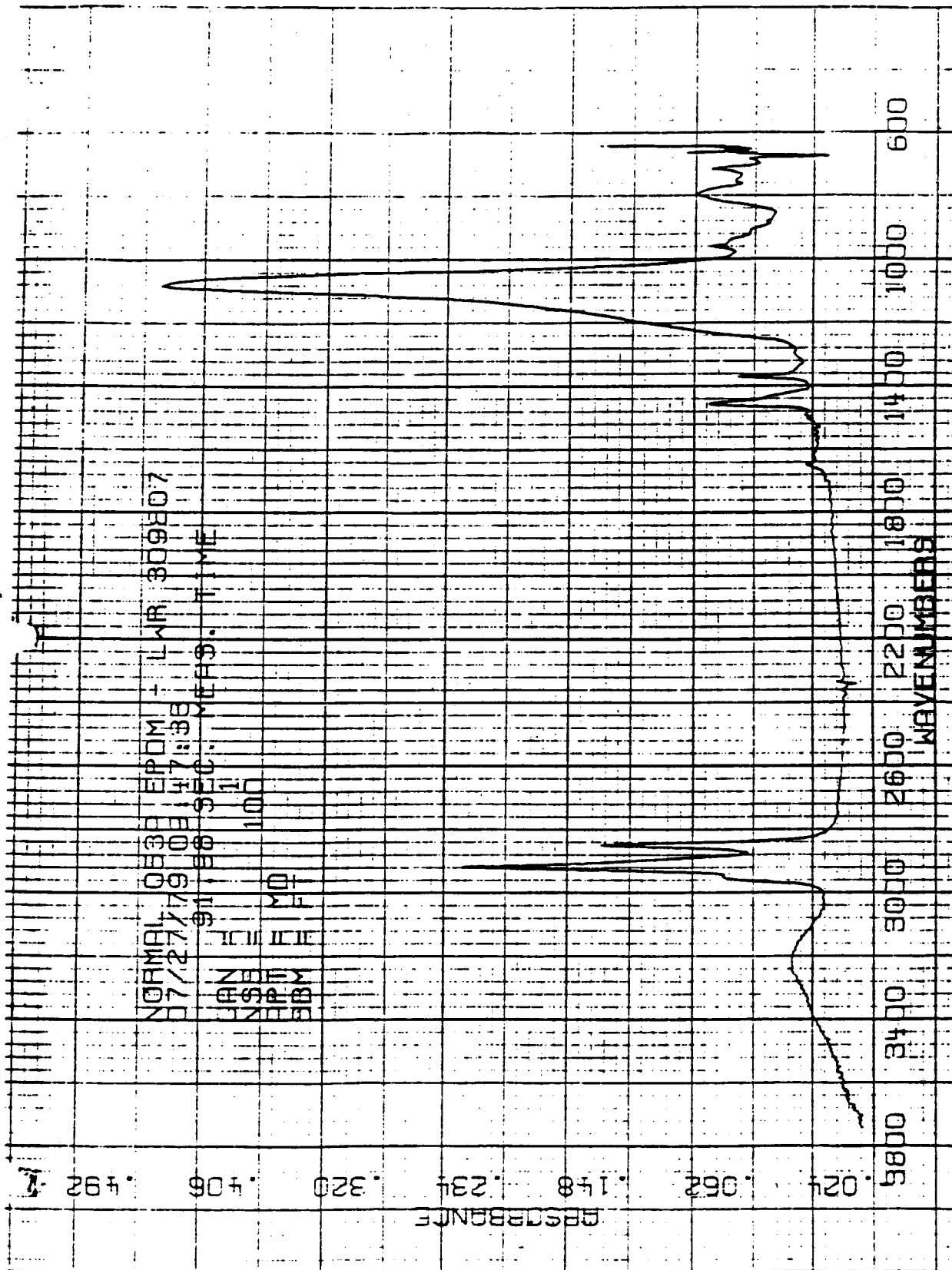
Cross-hatching represents tape.
Yellow represents EPDM rubber.

Figure 3. Placement of Non-Silicone Teflon Tape

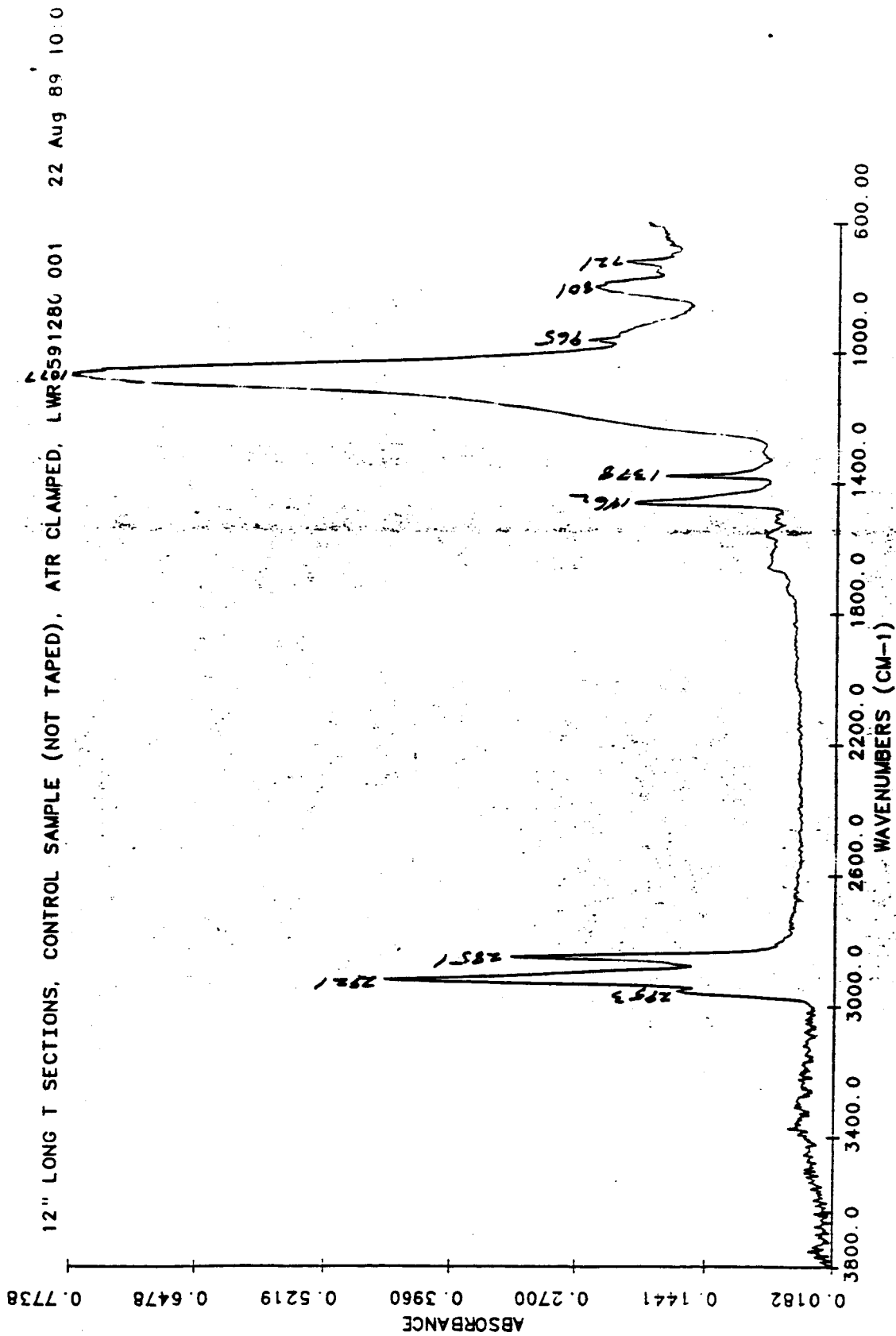
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Attachment I. FT-IR Analysis of EPDM Rubber



Attachment II. FT-IR Analysis of EPDM Rubber on Control Model

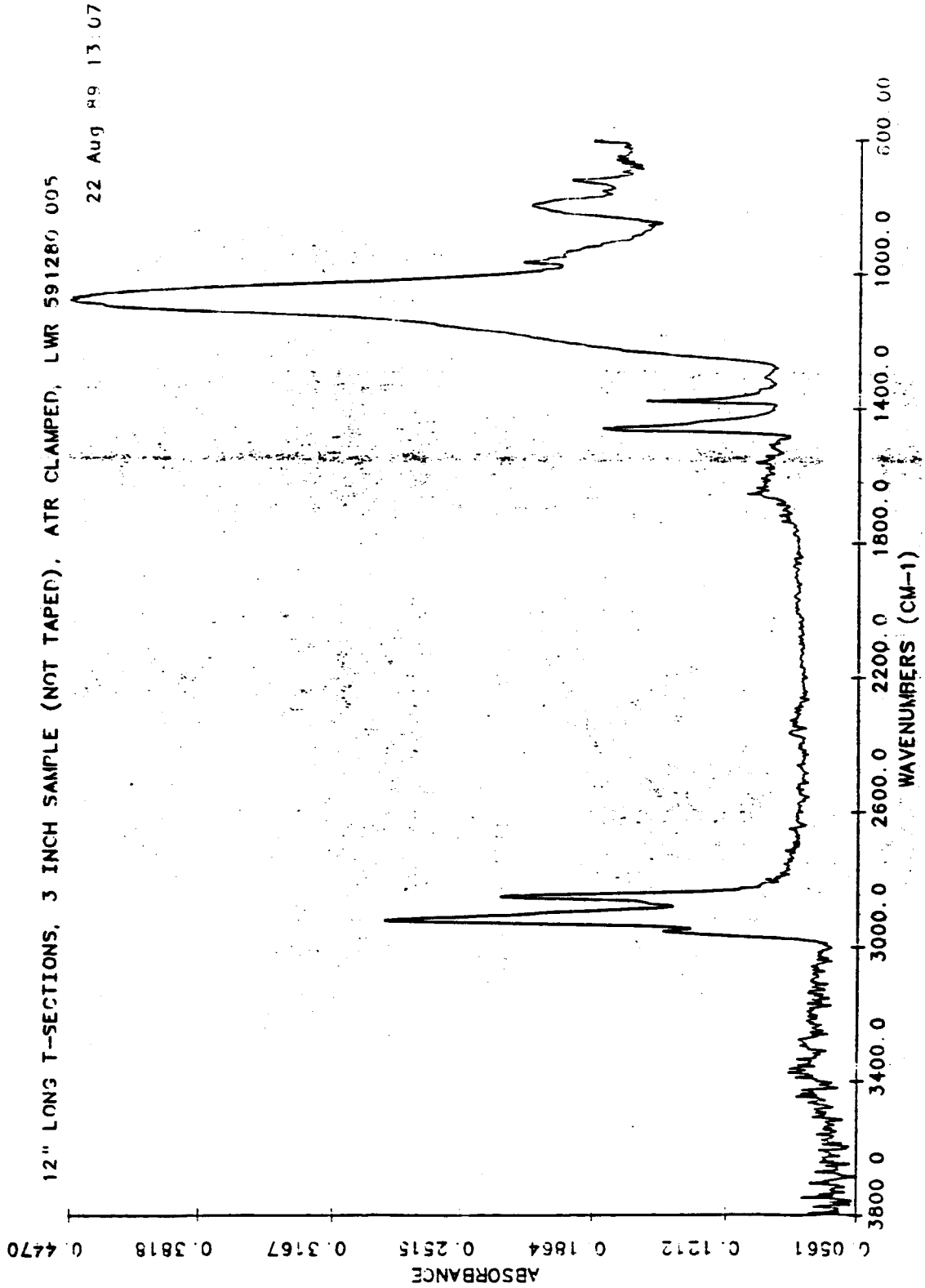


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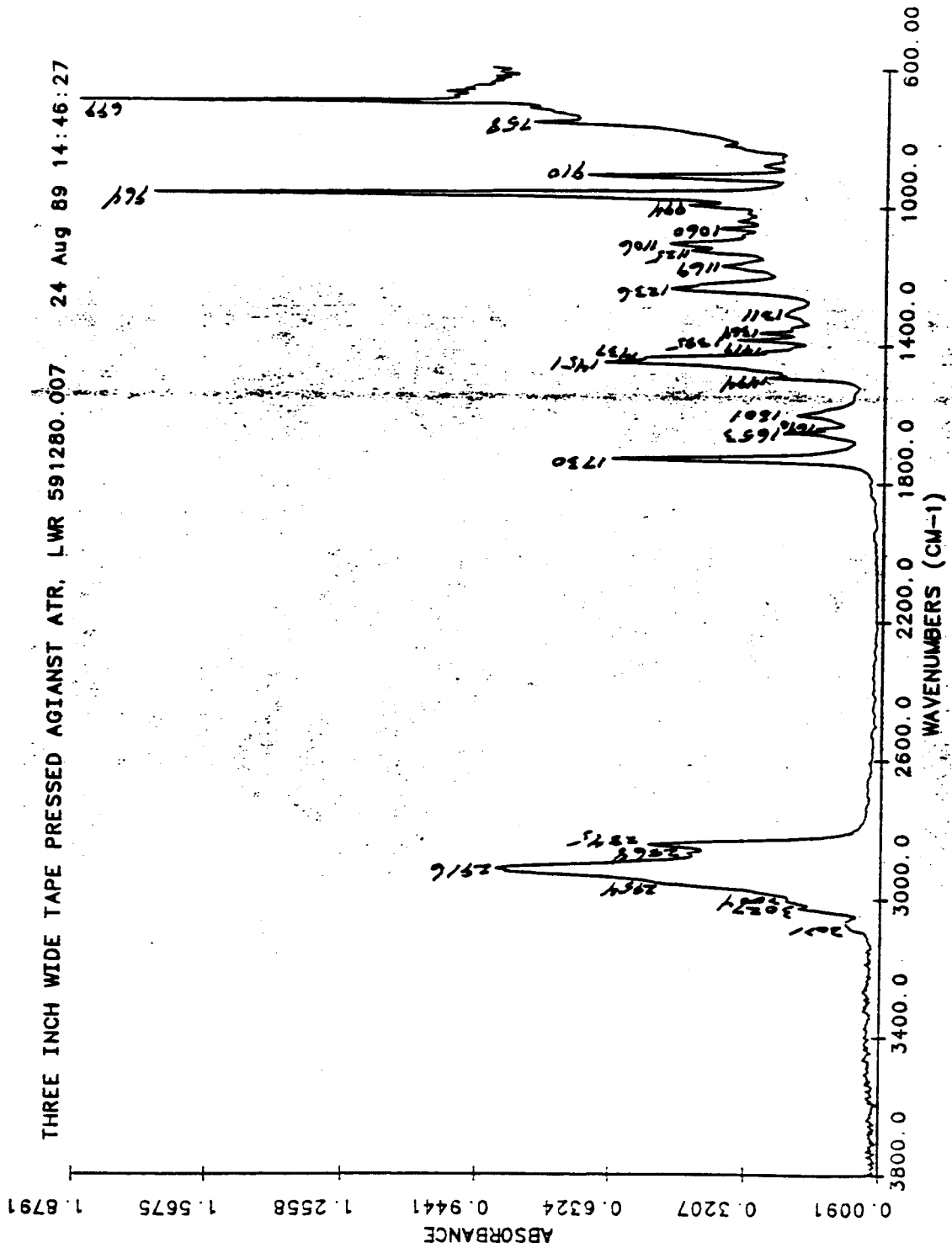
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Attachment III. FT-IR Analysis of EPDM Extrusion on 3-In. Tape Model



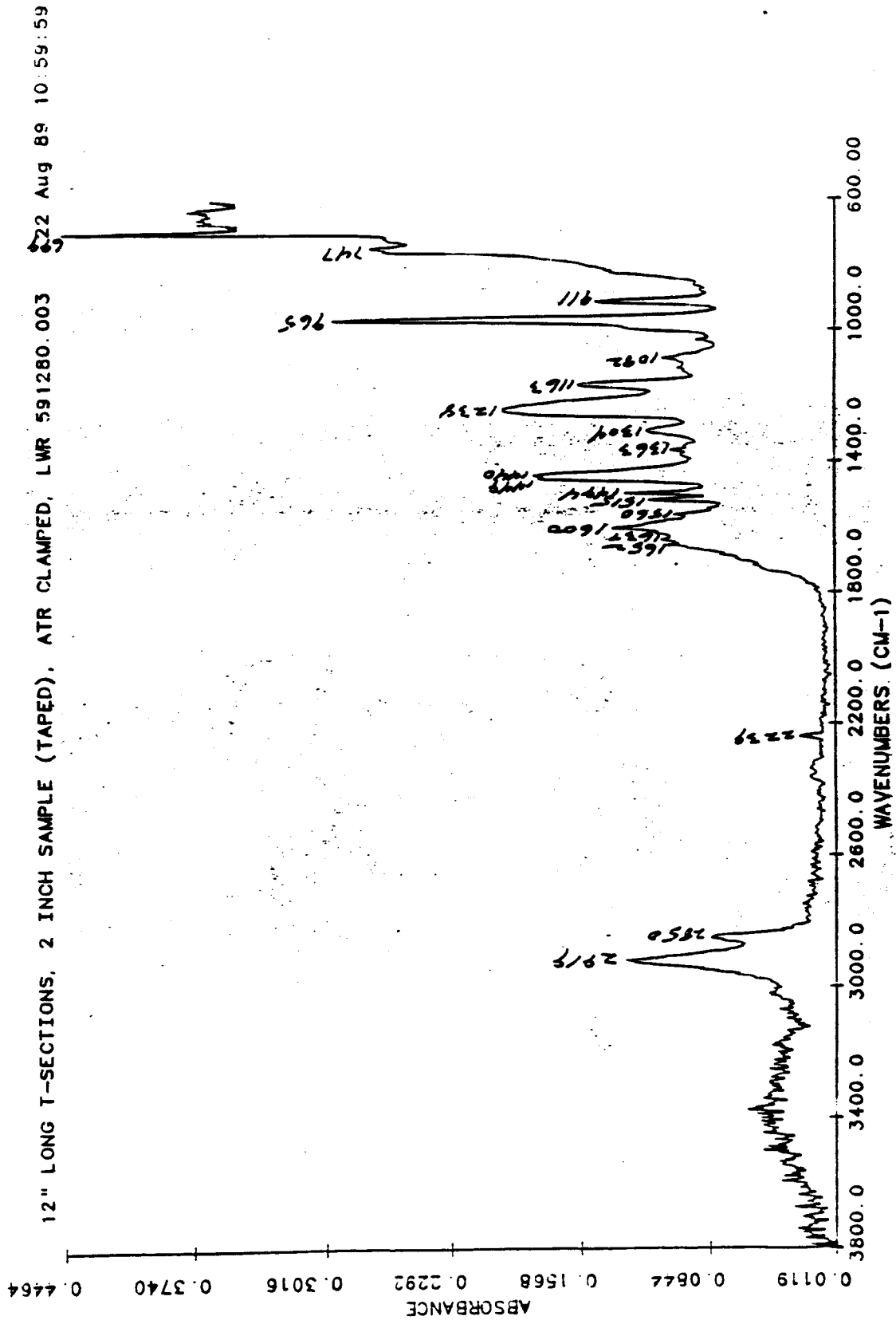
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Attachment IV. FT-IR Analysis of 3-In. Non-Silicone Teflon Tape



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Attachment V. FT-IR Analysis of EPDM Under 2-In. Tape



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